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ABSTRACT

Intended to inform administrators of vocational-technical education programs, and other interested persons, what the state of the art is in producing and using employment projections for educational planning purposes, this essay focuses on labor market concepts which should be used, but are now frequently abused, in the development and operation of information systems for managing and planning vocational-technical education programs. There are six chapters: (1) Introduction, (2) Employment Projection Models, (3) Employment Projection Methods: Strengths and Weaknesses, (4) Toward an Understanding of Labor Market Concepts and Processes, (5) Educational Planning Uses of Labor Market Concepts, and (6) Mission Impossible? Footnotes and bibliography are included with a note indicating that an integral part of this effort to convey an understanding of labor market concepts and reasons for their misuse or nonuse is a selective citation of relevant items from recent literature dealing with labor market and employment projection issues. (Author/HD)

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EMPLOYMENT PROJECTIONS FOR PLANNING VOCATIONAL-TECHNICAL EDUCATION CURRICULA: MISSION IMPOSSIBLE?

David W. Stevens

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HUMAN RESOURCES RESEARCH PROGRAM
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TABLE OF CONTENTS

PREFACE ---------- i

I. INTRODUCTION
- Purpose ---------- 1
- Background ---------- 2
- An Overview ---------- 3

II. EMPLOYMENT PROJECTION MODELS
- Introduction ---------- 8
- Model One: 'Same As Before' ---------- 8
- Model Two: 'Fixed Coefficient Production Function' ----- 9
- Model Three: 'Increased Labor' ---------- 10
- Model Four: 'Incremental Labor Output Ratio' ---------- 10
- Model Five: 'Skill and Industry Employment Forecasting'- 11
- Model Six: 'Skill and Industry Effects' ---------- 12
- Model Seven: 'One Stage Skill and Industry Effects ----- 12
- Model Eight: 'Regression Analysis' ---------- 13
- Models Versus Sources of Information ---------- 13
- Employment Projections Versus Forecasts ---------- 14
- Summary ---------- 15

III. EMPLOYMENT PROJECTION METHODS: STRENGTHS AND WEAKNESSES
- Introduction ---------- 15
- The Manpower Requirements Approach ---------- 16
- The Rate of Return Approach ---------- 19
- Comparing the 'Manpower Requirements' and 'Rate of Return' Approaches ---------- 19

IV. TOWARD AN UNDERSTANDING OF LABOR MARKET CONCEPTS AND PROCESSES
- Introduction ---------- 20
- The 'Shortage' Concept ---------- 20
- Projected 'Job Openings' ---------- 23
- Sources of Market Adjustment ---------- 24
- Internal and External Labor Markets ---------- 26
- Educational 'Requirements' ---------- 27
- Occupational Classification ---------- 28
- Supply Measurement ---------- 29
- Summary ---------- 30

V. EDUCATIONAL PLANNING USES OF LABOR MARKET CONCEPTS
- Introduction ---------- 31
- Communication Failures ---------- 31
- The Politics of Educational Planning ---------- 33

VI. MISSION IMPOSSIBLE?
- Introduction ---------- 38
- The Quest For A Vocational-Technical Educators' Cud ---- 38

FOOTNOTES ---------- 40

BIBLIOGRAPHY ---------- 47

PREFACE

This essay was written as part of a research project undertaken through the auspices of a grant (OEG-0-74-1736) from the Division of Research and Demonstration, Bureau of Occupational and Adult Education, Office of Education, HEW; conducted under Part C of Public Law 90-576. This project has produced three distinct products, each reflecting a specific objective of the overall effort.

The present volume is intended to inform administrators of vocational-technical education programs, and other interested persons what the state of the art is in producing and using employment projections for educational planning purposes. This essay is intended for informed laypersons. This is not a *how to* ... guide for technicians, although technicians will benefit from a careful review of the labor market concepts examined here.

A companion volume: David W. Stevens (ed.), Occupational Employment Projections for Program Planning Purposes: Issues and Examples, January 1976, contains the proceedings of a national workshop-conference held in July 1975. This conference brought together over one-hundred vocational-technical education and manpower planning technicians and administrators from thirty-one states and the District of Columbia.

The third product is an updated input-output matrix for the state of Missouri that provides sectoral employment coefficients which can be used by educational planners to examine interdependencies among different sectors of the state economy. In this way, account can be taken of major shifts in resource availability and pricing, such as the recent energy 'crisis'.

Since this research project was undertaken, in part, by a team which was also responsible for the production of employment and job-openings projections for the Missouri Occupational Training Information System (MOTIS), under contract with the Research Coordinating Unit, Department of Elementary and Secondary Education, the product of that activity would also be of interest to many readers. It is: Joyce R. Shackett, Employment and Job Openings Projections 1975-1981, Division of Career and Adult Education, October 1975. Complete documentation of the projection methods which were used, and identification of data sources, is included in the Shackett volume.

Jack Wilson, of the Division of Research and Demonstration, Bureau of Occupational and Adult Education, U.S. Office of Education, has provided outstanding guidance in linking our activities with the efforts of other researchers who are engaged in related analyses, to produce the maximum amount of educational program relevance possible.

Lexington, MA
January 1976

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EMPLOYMENT PROJECTIONS FOR PLANNING VOCATIONAL-TECHNICAL EDUCATION CURRICULA: MISSION IMPOSSIBLE?

I

INTRODUCTION

Purpose

This essay is intended to provide the reader with an understanding of some essential labor market concepts which should be used, but are now frequently abused, in the development and operation of information systems for managing and planning vocational-technical education programs. An integral part of this effort to convey an understanding of labor market concepts and reasons for their misuse or nonuse is a selective citation of relevant items from a voluminous recent literature dealing with labor market and employment projection issues.

Background

A starting point for this essay might be considered to be Kidder's *Review and Synthesis of Research on Manpower Forecasting for Vocational-Technical Education*[1], which appeared in February 1972. Kidder contains an excellent bibliography and synthesis of the state of the employment projection art four years ago, rather narrowly conceived as the title suggests.

Two national conferences[2] have been convened in the past nine months focusing, in part, on employment projections and vocational-technical education planning activities. At least two-thirds of the states are currently engaged in some type of occupational employment projections for educators' use.

The Bureau of Labor Statistics has embarked on a major new program called the Occupational Employment Statistics (OES) program, one part of which--the Occupational Employment Survey--is now operational in 29 states. Prime sponsors under the Comprehensive Employment and Training Act (CETA) of 1973 are frequently involved in generating projections of employment for their jurisdictional areas. Planners in the multi-county planning districts of the Economic Development Administration, U.S. Department of Commerce, are engaged in similar activities.

These are just a few of the organizations which are attempting to produce scenarios of future employment trends; each in somewhat different formats to meet real and imagined differences in information requirements for administrative decision-making. Public utilities, corporations, transportation associations, and investment groups are also generating their own scenarios of the future, so that they might be prepared to take advantage of new opportunities to generate profits, and to protect themselves against unexpected shifts in population location or spending patterns which would render previous investments less profitable.

There is much lamenting of this apparent duplication of effort in producing employment projections. At the same time, complaints are heard that the producers of employment projections aren't sympathetic to specific educational needs and requests; and there are countercharges that educators don't know what they want. One purpose of this essay, then, is to treat the essential conceptual issues in a manner which

might explain the alleged communication gap between producers and consumers of employment projections.

We proceed from fundamental concepts and illustrations of different types of projection models which are being used, to a consideration of what has led administrators of vocational-technical education programs to allocate resources to collect employment projection data, to include the information in planning documents, but then to apparently downplay it in subsequent administrative practice.

An Overview

One of the most frequent abuses of labor market terminology is a confusion of *demand* and *employment*. For now, *demand* will be considered only in the context of *effective demand*; i.e., the number of persons with particular qualifications which employers are willing and able to hire under stated conditions.[3] This simplification postpones the need to distinguish *effective demand* from *social demand*; a distinction that will be dealt with in a later section on shortages.

Employment is the outcome of interacting supply and demand forces. In other words, there is a set of unspecified determinants of the number of persons who offer their services (supply), and a second--not entirely different--set of factors which determines the level of effective demand. It is the outcome of these interacting forces which determines the mix and level of employment at a point in time, and the changes which occur through time.

Why is this distinction so important? Because today's employment pattern is a result of historical interacting supply and demand forces. Particular events, legislative actions, executive mandates, technological breakthroughs, managerial successes and failures, and consumer initiatives all have molded the present distribution of employment in our society. When we project recent employment trends into the future we are compelled to make either implicit or explicit assumptions about the continuity of these institutional forces and their importance relative to new factors which will influence the course of future employment.

Before we examine other labor market topics the reader must understand that *demand* is not synonymous with *employment*. Employers,

individually and collectively, may be prepared to employ more or fewer than the available number of persons with designated qualifications. The entire number they are prepared to employ is included in *effective demand*, but interacting supply and demand forces may result in a lesser number actually being *employed*. In many instances, it is apparent that vocational-technical educators have actually sought to discover, and eliminate, the difference between these two concepts; i.e., *effective demand* minus *employment*, which is sometimes called *net effective demand* or *unmet effective demand*. We will show why, in many cases, this is not an appropriate target for vocational-technical education planning.

The structure of observed employment is influenced by many factors. We can, for example, distinguish among at least five major sources of change in the mix of employment opportunities. In doing so, it is important to guard against a tendency to think of *change* as being synonymous with *growth*. Employment phenomena in recent years have restored our awareness that change can mean the demise of current opportunity, as well as the creation of new opportunity.

1. Simultaneous growth and decline in various sectors of the economy are counteracting processes which may leave the overall level of employment relatively unaffected, thereby masking large internal movements. It is this compositional transformation which wreaks havoc with long-range planning efforts.
2. Turnover is a major source of immediate job opportunity. Exits from employment occur for many reasons including retirement, death, disability, withdrawal from the labor force, transition to unemployed status while seeking alternative employment, and direct movement to another job. It is apparent that each of these reasons for exiting from a job has different ramifications for potential aspirants to a job. Some exits are permanent, others are temporary; some exits are voluntary, others are involuntary; and some exits convey warning signals about the appropriateness of the job itself for training purposes. It is important to recognize that many projections of employment encompass only estimates of the growth/decline source of

change plus replacement needs due to deaths and retirements (what we will later designate 'requirements'). Eventually, we must consider how important this limitation is for the purpose(s) at hand.

3. Relocation could be absorbed within the turnover concept, but we distinguish it to emphasize one important difference between local area employment projection activities and national projections. A local community, county, or state is more "open" than the entire nation, in the sense that movement of production of goods and services into and out of the political boundaries is more frequent. This makes it much more difficult to project future employment at the local level. International competitiveness must be considered in this context also. In fact, the international context illustrates the importance of legislative and executive actions as a determinant of employment. The enactment or removal of tariffs, for example, can have a dramatic impact on particular localities and economic activities.
4. Technological innovation can, over a relatively brief time span, dramatically alter the pattern of employment. Witness, for example, the recent introduction of light-emitting diodes (LEDs) in the mass marketing of wristwatches, clocks, and miniature calculators. At the same time, such innovations frequently wipe out, or at least substantially diminish, employment opportunities in the sectors which produce substitute items. A contemporary example is the introduction of computerized cash registers in retail establishments, which simultaneously accomplish recording of the sale, inventory control, and accounting procedures, thereby displacing human agents who had performed these tasks. There is substantial controversy about the autonomy of this technological change. Are technology and skill-requirements determined simultaneously, or is technology necessarily the prior phenomenon?

5. And finally, for present purposes, we distinguish a substitution phenomenon as a source of changing employment opportunity. All goods and services are produced by combining human services (labor) with "things" (capital). Depending upon a number of considerations not dealt with at this point, an employer usually exercises some discretion in deciding how these human services and "things" will be combined to produce a desired product or service. A crucial element in any employment projection exercise is to understand the nature of this discretionary action and the circumstances in which it will be manifested in different ways.

So, we see immediately that there are numerous sources of changing employment opportunity, only a few of which are accounted for in most employment projection activities.

Even if all of these sources of change in employment could be monitored with the desired frequency, a problem of *occupational classification* would remain. Much is heard of the conversions among the Census of Population (COP), the Dictionary of Occupational Titles (DOT), and the U.S. Office of Education (USOE) program codes. In the near future, a new fourth edition of the DOT will be issued. Preliminary work has been completed on a Standard Occupational Classification (SOC) system, which is intended to complement but not replace, the existing classification systems. What is sought in any occupational classification undertaking is relatively greater within-group comparability than between-group similarity. This seems simple enough, until we ask "similar with respect to what?" What criteria are to be adopted to distinguish among cases? With respect to occupations, for example, are we to classify only on the basis of job characteristics; or are people characteristics also relevant, to the extent that they are considered in hiring decisions? And, since the classifications are to be used for planning future vocational-technical curricula, should they reflect only current characteristics or speculative future characteristics too? Finally, is it clear that curricular planning should be attuned to single entry-level occupations, however defined, rather than to some other classification, such as job-ladders (a sequence of jobs through which people normally progress in a particular sector)?

In addition to sources of change in the level and mix of employment, and the proper classification of that employment, there are other major issues to be considered. One is the multiplicity of sources of skill acquisition. In some localities, and some occupations, public vocational-technical education provides most of the new trainees, but in other areas and other occupations this dominance simply doesn't occur. Indeed, most job skills currently in use have been learned *on-the-job!*[4] What are the consequences of this variation in penetration of a designated skill area, and what interactive forces exist among the sources of skill training?

Another major issue not yet introduced concerns the domain of control exercised by vocational-technical education administrators. It is one thing to recognize the desirability of reallocating educational resources; it is quite another matter to be able to marshall the necessary support to implement the desired change. This, and the related matter of multiple constituencies, are treated in later sections. More and better information about future employment opportunities is not always sought, so we must also examine the administrative incentives and disincentives which are likely to determine what priority employment projection activities receive, and why.

All of these matters are examined in the following pages. It is hoped that the reader who perseveres will acquire a better understanding of the concepts and practices which will ultimately determine whether or not employment projections contribute to better planning of vocational-technical education programs. And the reader who is interested can pursue any of the topics examined through the carefully selected bibliographic citations.

Since the major purpose of this essay is to examine our ability to produce, and desire to use, employment projections for vocational-technical education planning, it is necessary to ask not only whether we *can* produce acceptable projections, but also whether we *should* generate such information.[5] This strikes to the heart of the role of public vocational-technical education in our society. It is not our intention to delve into historical exploration,[6] but the reader should consider the rationale for tying the educational process to projected occupational employment opportunity.

II

EMPLOYMENT PROJECTION MODELS

Introduction

The purpose of this section is to introduce the reader to a number of different models for projecting employment, and then to examine the arguments by proponents and detractors of these and other methods. This is the most technical part of the essay.[7] For each model we state the underlying economic assumptions and the data requirements necessary to produce such a projection. Some readers may be tempted to forego this technical section and move directly to section III, but you are urged not to do so.

Model One: 'Same As Before'

Recalling that employment is the outcome of interacting supply and demand forces, this model simply assumes that the current employment pattern will continue into the future. It should be obvious that the accuracy of this model will be highly sensitive to the time span chosen. Saying that "this afternoon will be same as this morning" involves little risk of error, but applying this rationale to say "the last half of the '70's will be like the first half" involves much greater uncertainty.

Now, we must be careful in assessing the appropriateness of this assumption of no change, because the assumed absence of change is only in the *outcome* (employment) of interacting forces (supply and demand), not in the behavior of the forces themselves. These underlying forces may, for example, be expected to change substantially over the projection period, but in offsetting or compensating ways. Or, one might expect that these forces would change in the absence of countervailing action, but that such action will bar the adjustments from occurring. The introduction of wage controls illustrates the latter type of countervailing action, as might the imposition of quotas on entry to training in a particular skill area. The 'same as before' projection might, in such circumstances, be accompanied by a warning to the potential user that the projection is conditional upon continuation of the impediments to change.

The information required to use this model is, of course, the current employment structure described in whatever degree of detail one thinks is necessary to accomplish the administrative decisions required. Note that the currency of the required data is conditional upon how far *back*, as well as forward, one is prepared to assume no change in employment structure. This is clearly a very important issue, since we frequently hear, for instance, that decennial census data are "too old". For very stable employment sectors, depending upon the precision of the projection needed, census data may be quite satisfactory.

While data on the current employment structure is the minimal information requirement of any of the models we will discuss, it should be recognized that this simple statement leaves unresolved the classification issues of occupational (and people?) characteristics and geographic location, as well as the currency issue already mentioned. Even this minimal information requirement, then, can be extremely difficult to satisfy; witness the ad hoc nature of many current planning documents which require such data.

Model Two: 'Fixed Coefficient Production Function'

This unfamiliar terminology merely signifies an assumption that there is a rigid relation between labor inputs and production of a good or service. We have relaxed the model one assumption of no change in employment, but in doing so we have introduced a new information requirement. Estimates of the labor services currently used to produce given amounts of goods and services are now required. This is difficult enough to accomplish at the industry level with little or no occupational detail, let alone at the individual establishment level with full occupational detail. One problem is that all employed labor may not be contributing to current output, so that the "input-output" relationship is misspecified. In such an instance, we must either assume that the same amount of underutilization will continue in the future, or make some effort to adjust the relationship to take account of this factor.

Once the production function--the input-output relationship--has been estimated, it can be applied to the projected change in output level (growth or decline) between the current period and the end of the projection interval. This model requires two types of information not

needed in the 'same as before' model. Both methods require current employment information. In addition, the 'fixed coefficient production function' model requires data on the current relationship between labor service inputs and product or service outputs from production, and an estimate of the types and amounts of goods and services to be produced over the projection interval. And, as we have already noted, some assumption or information is required about labor which is employed but not used, or is underutilized, in production.

Model Three: 'Incremental Labor'

This is a straightforward adaptation of the 'same as before' approach, in which it is assumed that there is some constant trend of change in the use of skills or the level of employment. This approach may, or may not, require additional information depending upon the empirical foundation of the assumed incremental change in labor utilization. If the constant rate of change is to be estimated from observed historical experience, then information about the level and mix of employment is needed for earlier periods identical to that already required for the current period in the 'same as before' technique. Given ever changing industry and occupation classification systems, this may be a formidable undertaking.

Model Four: 'Incremental Labor Output Ratio'

Just as the 'incremental labor' technique is a simple modification of the 'same as before' approach, this model is a straightforward adaptation of the 'fixed coefficient production function' model. It might be characterized as a *drifting* fixed coefficient model, in the sense that the 'labor service input/good or service output' relation is assumed to change in some constant manner over the projection period. Again, as was the case in the incremental labor approach, more information may, or may not, be necessary to use this technique. If the constant rate of change in labor productivity which is to be introduced is to be estimated from past production experience, the data requirements of model two will be applied to the relevant historical period. Or, one might be satisfied to adopt estimates derived from other sources, or even to exercise one's own judgment about such trends.

We postpone, for now, an examination of the implications of

assuming a fixed production relationship, or a drifting production association, but the constraint may be severe and its relevance for vocational-technical education planning activities is likely to be significant. While the limitations of these techniques are severe, the information requirements to pursue alternative approaches are more burdensome, as we see below

Model Five: 'Skill and Industry Employment Forecasting'

In its simplest version, this technique assumes that all substitution between the "things" inputs to production (capital) and the labor services inputs occurs *within* each industry sector, however one chooses to define industry for projection purposes; and, that substitution among skills occurs without regard to industry. Temporarily, skill and occupation are treated alike, although an occupation is normally comprised of more than one job each of which requires multiple skills. Of course, we know that these are very unrealistic assumptions. In fact, supply and demand forces, as they are manifested in technological change and evolving skill utilization patterns, operate throughout the entire economic fabric with greater and lesser degrees of interdependence among individual sectors artificially designated as industries and occupations. Realism, per se, is not our objective. But, insofar as assumptions knowingly contradict the actual economic processes, we should at least be sensitive to the likelihood of error being introduced.

Restating the assumptions made, we proceed as though substitution among skills occurs uniformly across industry sectors. This means that if we project a ten percent increase in the employment of electronic technicians over the projection interval, this percentage increase will be applied uniformly across all industries in which electronic technicians are employed. And, our assumption of uniformly distributed changes among occupational categories within an industry sector means that a projected ten percent increase in automobile production during the projection period will be manifested in an across-the-board ten percent increase of employment in all occupations within the auto industry sector.

Now, these may strike the reader as very unsatisfactory assumptions because intuitively we know that they are inaccurate. Deferring the

important point that accuracy should always be considered relative to the purpose at hand and not as an absolute, let us examine the information requirements of this and alternative, more realistic, approaches. As the technique has been presented it requires information on the current level and industry/occupation mix of employment--the same requirement as each of the previous models--as well as additional data on projected aggregate employment by industry and projected employment by occupation across all industries.[8] Of course, producing these industry and occupationaly employment projections requires making a series of assumptions about the determinants of each.

Model Six: 'Skill and Industry Effects'

This modification of the 'skill and industry employment forecasting' technique provides, for the first time, consistency of the occupational and industry employment projections within the respective subsectors, as well as with the overall projected employment level. This involves a sequential computation process, a description of which would take us too far afield.[9] While the computational process is more complex, the original information requirements are the same as for the less restrictive 'skill and industry employment forecasting' method.

Model Seven: 'One Stage Skill and Industry Effects'

This is a simplified version of model six which shortcuts the sequential convergence of subtotals by incorporating industry coefficients which are the projected rates of growth (decline) of total employment by industry, and skill (occupational) effect coefficients which reflect the proportionality of projected occupation employment totals to those which would have been projected in the absence of allowances for an independent occupational substitution phenomenon. This method does not provide simultaneous satisfaction of both the industry and occupational subsector constraints, but only the latter.

Models six and seven can be estimated in either of several ways: By projecting industry and occupation employment totals and then estimating the respective industry and occupation coefficients to be applied to complete the industry/occupation matrix; or by estimating the coefficients directly from a series of complete historical industry/occupation matrices.

Model Eight: 'Regression Analysis'

Given the availability of a time-series of complete industry/occupation matrices, this technique conceptually allows virtually unlimited flexibility in the choice of functional relationships. Realistically, the nonavailability of data on derived determining factors usually limits the analysis to a simple regression of occupational employment by industry on industry output and a time factor which represents a multitude of unspecified productivity influences.

Models Versus Sources of Information

We recognize that the preceding section was unfamiliar to most readers, and much too brief and general for others. Some may wonder why mention has not been made of specific "projection methods" like local area skill surveys, or the Bureau of Labor Statistics' Tomorrow's Manpower Needs industry-occupation matrix and occupational employment surveys. So, let's pause to distinguish *projection techniques* from *information sources*.

In the previous section we described eight *models* to project employment. In this context,

> [a] model of something is a representation of it designed to incorporate those features deemed to be significant for one or more specific purposes. In some cases such features are directly observable... . In other cases models incorporate more subtle features such as how the thing modeled responds to stimuli or otherwise behaves.[10]

A model, then, is a statement of relationships among factors. One goal of modelling activities is to accomplish the investigator's purpose with as simple a representation of interrelationships as possible. Realism, as such, is usually not a goal of the modelling process. Predictive accuracy is frequently the major objective of a model. A major concern is to identify beforehand the degree of precision sought, so that attention can be devoted to developing the least complex model possible which achieves this level of accuracy.

One of the most pressing issues accompanying current investments in employment projection activities for vocational-technical education planning purposes is a general failure to date to decide ahead of time, or even after the fact for that matter, what level of accuracy is required, so that employment projections can be assessed relative to a

specific target. A corollary of this failure to specify accuracy targets is a frequent resort to "gut reactions", which are necessarily poorly informed, in favor of, or against, particular employment projection models. In the next section we hope to contribute to improving the grounds upon which such decisions are rendered.

First, however, it is necessary to assure ourselves that the distinction between model and data source is clear. An area skill survey, for example, is merely one way to collect information about current and projected employment. However, a model of interacting forces which influence employment is implicit in the way in which the projection part of the survey is conducted. Hopefully, the underlying assumptions will have been made explicit to the respondents; otherwise, the information which is collected from individual establishments cannot be combined. The BLS industry-occupation matrix is another data source, not a model. It can be used under a wide range of alternative assumptions about the employment process (models) to produce employment projections.

So, the individual who must choose among alternative employment projection models may, or may not, also become enmeshed in the selection of data sources. At least some familiarity with the availability of the latter is necessary in order to eliminate those models which require information which cannot be produced. In many instances data availability is not an absolute matter; it can be produced at some finite cost. This makes the decision process more complex, because it introduces comparisons of speculative costs which are difficult to assess.

Employment Projections Versus Forecasts

Still another crucial distinction which must be drawn is that between a *conditional projection* and a *forecast*. A conditional employment *projection* is in the form of an implicit "if...then" statement. The employment projection is conditional upon the appropriateness of the underlying assumptions. An employment *forecast* is a "best guess". It is not offered conditional upon realization of the assumptions made. It is the forecaster's informed judgment about what is expected to occur.

The distinction made here may appear subtle to the reader, but it is actually a major source of ill-will inappropriately directed toward

some modelling efforts. Some employment projections have been calculated with careful documentation of the assumptions which were made in producing the estimates. and upon which they are therefore conditional. However, at some point in the transmittal from producer to consumer these accompanying assumptions have been overlooked, and thereafter the estimates have been treated as the producer's informed best guess of the future employment structure. When the employment estimates are then found to diverge from actual trends, the analyst's qualifications to do the desired job are questioned, and "gut feelings" about the projection technique adopted turn sour.

One method which has been tried to reduce the likelihood of misuse of projections as forecasts is to simultaneously present several projections under clearly stated differences in assumed economic conditions and institutional parameters, with accompanying instructions to the consumer regarding the criteria to be applied in choosing one of these for planning purposes.[11]

Summary

We have tried, in this section, to lay a foundation for examination of the different employment projection models which are, or could be, available for planning vocational-technical education expenditures. At the same time, we have distinguished between several important terms which are frequently misused. The stage is now set to consider the strengths and weaknesses of various employment projection techniques.

III

EMPLOYMENT PROJECTION METHODS: STRENGTHS AND WEAKNESSES

Introduction

This section makes no original contribution in assessing the pros and cons of employment projection models. Its contribution lies in attempting to convey enough of an understanding of the technical analyses which others have conducted to increase the likelihood that administrative decisions concerning investment in employment projection activities, and the products thereof, will be informed choices.

With few exceptions, what little scientific analysis that has been

performed has been limited to rather highly specialized occupational or industry sectors. Particularly, in the past decade attention has been focused upon higher education,[12] the health professions,[13] the engineering and scientific community,[14] and developing countries.[15] One major stumbling block appears to have been naive attempts to introduce such techniques into vocational-technical education planning with little attention being paid to institutional differences in the respective sectors of application.

Of three popular manpower planning models[16]--social demand, rate of return, and manpower requirements--the latter has clearly swept the field to date. The *social demand* approach proposes attuning educational offerings to constituent preferences, which requires assumptions that such preferences are well-informed and signaled in a way which results in an equitable distribution of educational opportunity. In fact, as public enthusiasm for the efficacy of education as a vehicle for economic mobility wanes, and as professional examination fosters skepticism that institutional skill acquisition is the primary determinant of economic opportunity,[17] there is accumulating evidence that educational administrators are indeed becoming more sensitive to student demands. But, are these informed demands? If they are informed by relative earnings potential, and if we make certain assumptions about what earnings reflect, this method folds into the *rate of return* approach which bases allocative decisions on relative cost-benefit criteria. We will return to examine this approach.

The *manpower requirements* approach assumes just that--that there are identifiable requirements for labor services which can be derived from judgments about the structure of production and that these can be translated into educational requirements, which in turn can be treated as targets for educational activities.

The Manpower Requirements Approach

The simplest requirements approach is model two in the preceding section, the 'fixed coefficient production function' technique. This approach only requires a description of the current employment structure and the projected pattern of production. From these data one can derive a quantitative estimate of the differences, plus and minus, between the

current employment structure and the projected target employment structure. Recall, though, that this model assumes no change in labor productivity over the projection period, and no possibility of substitution among types of workers, or between labor services and "things" inputs (capital).

Hollister[18] states the problems raised by consideration of the simple requirements, or 'fixed coefficient production function' approach in the following way:

> There are two major questions: (1) is the impact of manpower requirements on the educational system quantitatively significant enough to justify the considerable effort involved in making detailed estimates of requirements? (2) if the answer to (1) is yes, are present methods so inaccurate that, for all practical purposes, requirements cannot be estimated? Further questions spring from (2) concerning the possible sources of weakness in present forecasting methods:
>
> 1. Are occupational-input coefficients (the number of workers in a certain occupation per unit of output) at a given point in time fixed, or are they variable, and what difference would it make if they are in fact variable? This is the so-called 'substitution problem'.
> 2. To what extent do uncertainties about changes in productivity (changes in output per man due to changes in technology) affect estimates of manpower requirements?
> 3. To what degree must the economic structure and the labour force be disaggregated (e.g. into economic sectors, industries, firms, broad skill groups, or detailed occupation categories) if reliable estimates are to be made?
> 4. How serious is our ignorance of the exact relationship between a given occupation and the educational background 'required' for it and what difference does this ignorance make to the usefulness of educational targets derived from estimates of manpower requirements?

Of course, since enactment of the 1968 Amendments to the Vocational Education Act of 1963, federal approval and funding of a State Vocational Education Plan has been conditioned upon inclusion of estimates of future employment by curricular program area. The answer to Hollister's first question is therefore a qualified "yes", but this leaves undefined what is meant by "...considerable effort involved in making detailed estimates of requirements."

Over a decade ago, Herbert Parnes[19] asked "[i]sn't it a dangerous delusion . . . to pretend that we can answer questions like these with confidence?" He then proceeded to note that once having decided that specific skill development in preparation for employment is an educational goal, there is no longer an option to project employment or not; the only option is whether to do this explicitly in a scientific manner, or implicitly by happenstance. And, Parnes continued, projection of manpower requirements is a technological exercise, not an economic undertaking. This brings us back to a point made in the introductory section. *It is not demand that is being projected.* Once the structure of future production is projected, using one of the eight models described in Section II, the labor services requirements to produce that pattern of goods and services are determined. This is a conditional determination, dependent upon the particular assumptions of the model adopted. There is no explicit consideration of the interaction of supply and demand forces, and no statement of the behavioral responses of the economic actors. The most rudimentary requirements projection method simply asserts "if this is what you want, or expect, to produce in time period t, then here are the skill (occupational) requirements to get the job done, assuming no change in labor productivity and no substitution among skills."

Pause to consider for a moment how an economy with these characteristics would function. Since we have said nothing about the availability of individuals with the required skills, beyond presumed knowledge of the distribution of the currently employed, let us assume that the labor force is transformed in some unspecified way to exactly match the projected labor services requirement structure. Then, any deviation of the actual development of production from the projected structure would be impossible, since the required skills for a different structure would not be available. Such a rigid characterization is clearly unrealistic. Is this characterization a useful approximation, though? The assumption of zero substitutability may be unrealistic, yet still be functional for planning purposes relative to available alternative assumptions. What alternative assumption is available?

The Rate of Return Approach

A polar extreme would be to assume infinite substitutability among skills. This premise would provide a basis for computing internal rates of return[20] for educational programs one wishes to compare. These rates of return could then be used to guide the development of vocational-technical eduation programs. Quite apart from the sequence of assumptions that is required to produce an internal rate of return calculation (e.g., earnings-productivity relationships), and bypassing examination of the appropriateness of choosing among educational programs based upon this criterion, this approach produces no target number of people to be trained in various skills to equalize their rates of return. If a skill area has an unusually high payoff (high internal rate of return relative to alternative programs) then it is an obvious candidate for expansion, but by how much? The rate of return technique provides no guidance in this regard, without engaging in constant recomputation to identify convergence of the relative attractiveness of this investment with others.

Comparing the 'Manpower Requirements' and 'Rate of Return' Approaches

The requirements approach identifies specific numbers of persons with designated skills that will be required to produce a given output. *If* this output mix is to be feasible, *then* the skill requirements must be met. No consideration is given to market adjustment mechanisms; or if such forces are considered, they are assumed to exhibit zero, or nearly zero, influence.

The rate of return approach assumes that the economy will absorb people regardless of their embodied skills. Substitution among skills in production is assumed to be unlimited. The important issue then is comparative benefits and costs of training programs.

It is apparent that a major difference between these two approaches is their respective assumptions about substitution possibilities in production. What can be said about this matter? Very little, without digressing into technical issues which would take us far beyond our intended scope of coverage. This analytical area is fraught with dangers for the layperson. As one might have anticipated, the limited available evidence is supportive of neither polar extreme.[21] For

present purposes, two observations about our understanding of these substitution phenomena can be made. First, because of data availability, the most precise estimates cover only the manufacturing sector. And second, the degree of aggregation of occupational categories has been so great that very limited information about refined skill substitution phenomena is gained. In other words, we are thrown back to our "gut reactions" to a large extent in deciding whether the requirements assumption of no substitution is acceptable. It is in this context that an understanding of labor market concepts will contribute to a more informed judgment.

IV

TOWARD AN UNDERSTANDING OF LABOR MARKET CONCEPTS AND PROCESSES

Introduction

We have distinguished between *demand* and *employment* which is an outcome of interacting supply and demand forces.[22] We have also identified the requirements technique as a technological approach which implicitly assumes an absence of any labor market adjustments. We now turn to an explicit consideration of the *shortage* concept, and then examine Hansen's[23] five-way classification of employment projection efforts. This will, in turn, provide a basis upon which to consider how skills are developed.

The 'Shortage' Concept[24]

What does a reported *shortage* of registered nurses mean to you? Does it mean the same thing as a *shortage* of physicians in rural areas, or a *shortage* of good teachers in inner-city schools?

Consider the following definitions of shortage. First, one might appeal to relative incomes and define a shortage to exist if the number of qualified persons offering their services increase less rapidly than the number demanded at recently observed salary levels. Under such conditions rising relative earnings should be observed if earnings are accepted as an accurate signal of labor market imbalance.

Second, we might adopt the rate of return criterion and define a shortage as existing whenever the rate of return in an occupation is

higher than in other occupations, or if it has been rising relative to others.

Note that the first definition above does not take the cost of skill acquisition into account at all in designating the existence of a shortage. The second definition does consider costs, but there is no explicit link between this concept and the existence of job-vacancies.

A third concept, which has been called a dynamic shortage to characterize its temporary nature, has been applied when relative earnings are temporarily too low to immediately clear the market for a particular skill. We will see that this type of shortage may be of particular importance for vocational-technical education planning activities because it implies that adjustments are underway to achieve balance in the market, but that these adjustments occur with some lapse in response time.

A fourth shortage concept which has been very popular in the examination of markets for health occupations includes all social demands, not just effective demands. Recall that *effective demand* is backed up by a willingness and an ability to employ qualified applicants up to a designated number at the stated compensation level. *Social demand* includes a stated preference, or need, for some number of qualified persons, but not necessarily accompanied by a willingness or ability to employ. The supply shortfall in this type of calculation might never be extinguishable because of continuing adjustments in the concept of social 'need'. The physician shortage concept illustrates this case. There are varying opinions as to what the proper physician/population ratio should be, and whether it should be the same in rural and urban areas. This ratio currently varies widely among countries, and among areas within a given country. By applying a single high physician/population ratio observed in one area, one can create an impression that there are shortages in all other areas which exhibit lower ratios. But, there may be few or no existing or forecast job-vacancies (effective demand minus the currently employed) in these areas. Would newly emerging physicians be absorbed into these rural sectors to reduce the asserted imbalance in physician/population ratios? Not without some reallocation of *effective demand* to these areas, i.e.,

a desire to employ coupled with an ability to pay the requisite salary. Of course, what has occurred in recent years is that most medical school graduates have entered practice in metropolitan areas where presumably their presence has reduced the earnings potential of their predecessors below what it would have been otherwise, while at the same time increasing the interregional disparity in physician/population ratios.[25]

A fifth shortage concept introduces the cost of acquiring labor market information. The number of qualified applicants may fall short of effective demand only because of information imperfections. Increased expenditure on recruitment of already qualified persons who are not currently employed would contribute to a reduction of this type of shortage.

A sixth concept involves interdependencies and rigidities in relative earnings, so that necessary market adjustments cannot occur, or occur with long lags. As we note in the next section, this may in fact be one of the most important causes of long-term imbalances in some markets.

A seventh shortage concept assumes that the availability of qualified persons is very inflexible, particularly over a short time-span. This inflexibility may be associated with the time necessary to produce the necessary qualifications, or with barriers to entry into the occupation or into the training pipeline prior to job-entry. In these instances, even rapidly rising relative earnings may not alleviate an imbalance, at least not quickly.

An eighth shortage concept takes account of the possibility that the stated job qualifications may be absolutely fixed in quantity, in which case observed market imbalance, as measured by any of the preceding indices, should evoke no response other than to perhaps advise the actors in the marketplace of the situation; i.e., reduce the existing information imperfection.

And finally, a ninth shortage concept is adopted by those individuals or groups which simply assert that our priorities are misguided and that we need more people with skill x. This notion is similar to that described as the fourth concept above (social demand).

The reader must realize by now that the concept of a skill

shortage is very vague in its common usage. Unfortunately, there is yet another major source of ambiguity; what is meant by "projected job openings"?

Projected 'Job Openings'

A projected *job opening* is not the same as a job vacancy. On the one hand, a *job vacancy* exists only if an employer is willing and actively seeking to hire. Projected *job openings*, on the other hand, involve one or more of the following five concepts distinguished by W. Lee Hansen[26]:

1. Requirements--reflects replacement and growth (plus or minus) 'needs' over a specified time-span, based on assumptions about the level and mix of economic activity, technological phenomena, the availability of qualified persons to meet the expressed 'need', and stability of the institutional structure. Replacement typically only accounts for deaths, retirements and other permanent withdrawals from participation. Not included is job turnover among continuing labor force participants, which is the source of most job vacancies, as we noted in the introductory section.
2. Availables--represents the projected number of applicants who will be available to fill the requirements estimated in 1. above. Again, assumptions are made about the forces which impinge on the decision to acquire skills and offer labor services in the market. Knowledge of the forces which determined current supply patterns is useful in projecting future availability.
3. Outcomes--is the difference between 1. and 2. above (requirements minus availables). This is, in a sense, a measure of the unmet requirements (shortfall or surplus) allowing for no feedback effects based on an awareness of this gap. Many educational administrators are using a version of this concept to meet their reporting requirement to consider manpower criteria.
4. Outcomes With Responses--is a much more appropriate concept to adopt for administrative planning purposes, but

one that is far more difficult to estimate. This concept takes into account the expected responses outside ones own domain to awareness of the original outcomes projections. Since assumptions about supply and demand conditions were incorporated in the calculation of requirements and availables, it is now necessary to correct for disparities between the assumptions made and the projected situation. How will the respective actors behave in the face of new information about a projected surplus or shortfall of availables relative to requirements?

5. Actuals--refers to a reconciliation of outcomes with responses. Given the projected relationship of requirements and availables after the feedback effects of knowing what would occur outside ones own domain in the absence of any response have been considered, it is finally appropriate to define the role of ones own administrative responsibility. What "piece of the action" is to be accepted as the projected participation of your unit?

Enthusiasm for the simplicity of this sequence should already be tempered by the many complexities examined in previous pages, but lest the reader conclude that calculation of outcomes with responses is straightforward, we state unequivocally that it is not an easy undertaking. For example, what responses are at issue?

Sources of Market Adjustment

Our purpose here is to illustrate the variety of sources of responses to labor market conditions which might occur. Assume, for example, that the estimate of 'outcomes' for a given situation reflects an inadequate number of availables to meet the projected requirements. What actions might be taken to correct this apparent imbalance?

1. Institutional training--provided at public and/or private expense. Anticipation of one sector's willingness to bear the costs of training would presumably influence the enthusiasm of the other sector's actors to participate in the financing of training.[27]
2. On-the-job-training--provided at public and/or private expense. As in the case of 1. above, public and private

sources of support may be considered as substitutes. Required matching contributions are an exception.

3. Relocation of production or applicants--an imbalance in the projected availability of qualified applicants might be corrected by physical movement of the production activity to a location with more satisfactory labor market conditions. Alternatively, relocation of applicants to the current site of production could be subsidized.
4. Change in the rate, or mix, of production--if the rate of flow of output can be varied, and if the nature of the product or service forthcoming can be altered, new options become available to adapt production to labor force availability.
5. Change in the method of production--distinct from altering what is produced and when it is produced, consideration can be given to how production is carried out. The economist's notion of a production function is relevant here. What alternative mixes of inputs will result in a given level of output? Once substitution possibilities among factors are considered, a variety of new options may appear. Or, it may be discovered that the type of labor which is projected to be in short supply is a critical input for which there are no available substitutes. Consideration of factor substitution involves both intra-factor and inter-factor possibilities. Can a job be decomposed into several parts each of which requires fewer skills, so that less-skilled labor can be substituted for more-skilled labor? This is an intra-factor comparison. Or, can a labor input be replaced by an electro-mechanical device? This is an inter-factor comparison.
6. Investment in recruitment--again at public and/or private expense. Taxpayer support of a public employment service exemplifies the former, and expanded company personnel operations illustrate the latter. In part, recruitment expenses can substitute for other adaptive actions mentioned above.
7. Change in wages--where 'wages' is intended to encompass all aspects of compensation including working conditions. Market

wages can be supplemented, or altered in real value through tax treatment, or even established through legislative action.

What should be clear from this illustrative listing of possible responses to projected imbalances is that estimation of 'outcomes with responses' is difficult. The planning task confronting the administrator of any single channel of skill augmentation or other market adaptation is also complex. Will a projected net imbalance prove illusory because of unforeseen adjustments from other sectors?

Note too, the consistency with which public and/or private sources of support for a particular adjustment process were mentioned. The interdependence of decisions in the two sectors is of considerable importance.

Internal and External Labor Markets

Having mastered the distinctions between *demand* and *employment*, a *projection* and a *forecast*, a *job vacancy* and a projected *job opening*, and the concept of a *shortage*, we now add what is perhaps the most important concept of all for planning vocational-technical education curricula--the distinction between *internal* and *external* labor markets.[28]

While there are examples of structureless labor markets, e.g. parts of the seasonal harvest labor market and casual labor "shape-ups", most markets are characterized by a number of institutional impediments to the rapid adjustment of supply and demand forces which are assumed in formulations of competitive market processes.[29] One of these institutional impediments is the existence of limited *ports-of-entry* into employment for a given firm. This *ports-of-entry* concept is of great importance for vocational-technical educators. All jobs in our economy are not open to every bidder, or even to every "qualified" bidder in the normal use of that term. Many jobs are only open through internal promotion or transfer. There are many reasons why the *internal labor market* arises to close off competitive bidding from the *external labor market*.[30] Ports-of-entry from the external market into the internal market exist in many different patterns, but they are concentrated at lower levels from which one may be able to advance through the internal occupational hierarchy. Much--many experts say most--skill development necessarily takes place within this internal market because of task-

specific and establishment-specific characteristics of jobs. Williamson et al.,[31] for instance, emphasize four idiosyncrasies which require learning-by-doing; i.e., learning through joint on-the-job training and production. First, equipment idiosyncrasies are cited which are associated with common but incompletely standardized machinery, tools, etc. Second, process idiosyncrasies are distinguished which flow from the operating production context itself. Third, informal team accomodations are identified stressing performance interdependencies among the group. And fourth, communication idiosyncrasies are noted which can only be learned through on-the-job experience. The more important these employer specific peculiarities are, the less prior preparation can be accomplished in an external institutional education setting.

Up to this point we have emphasized a partial *inability* to offer idiosyncratic training in other than an on-the-job setting. If the trainee would be expected to be allowed to compete for the trainer's job at the completion of the learning process, there may also be an *unwillingness* to train. Presumably, this disincentive would operate less strongly in the institutional setting than on-the-job. "The success of on-the-job training is plainly conditional on the information disclosure attitudes of incumbent employees . . .. The danger is that incumbent employees will hoard information to their personal advantage . . .."[32] *Fully* qualified competitors are a threat to the job security and/or earnings potential of incumbents. Would you teach someone "everything you know" about your job unless you had some guarantee that they would not then turn around and bid for your job?[33]

The presence of internal labor markets is important in our consideration of occupational employment projection activities because the structure of internal labor markets simultaneously determines, and is determined by, in part, pre-employment educational requirements. At the same time, internal labor market considerations are important in understanding employment turnover levels and structure.[34] What is meant by the concept of an *educational requirement* for employment?

Educational 'Requirements'[35]

Most planning of vocational-technical education programs is premised on the existence of well-defined and stable skill requirements which are known with varying degrees of precision; skills which can be

produced in classroom or work station settings. While there is little doubt that there are specific cognitive skills which can be learned in an institutional setting, there is substantial controversy about their necessity and stability in production processes. Are they *requirements?* This is really a two-part question. First, is the production process itself rigid; i.e., is the 'fixed coefficient production function' model in Section II an accurate description of significant sectors of the economy? And second, is the pre-employment development of specific skills a necessary criterion to be hired?

There is a voluminous literature which examines the contribution of education to productivity,[36] and a developing literature which challenges this orthodoxy.[37] It matters very much whether education's major contribution is direct enhancement of productivity, or a screening of *potential* productivity. One would not necessarily expect an optimal education technique which imparts direct productivity development to also be optimal in performing screening functions.[38] An understanding of which of these roles best characterizes vocational-technical education activities is dependent, in part, on our understanding of the purpose(s) and structure of occupational classification systems.

Occupational Classification

A former Secretary of Labor, and a former Assistant Commissioner for Manpower and Employment Statistics in the Bureau of Labor Statistics, have recently concluded that

> [e]xperience makes it clear that any effective projection of future employment prospects in particular occupations depends on the development of occupational employment information on an industry-by-industry basis . . . . .
>
> It would speed up the obtaining of current occupational employment statistics if there were a standard occupational classification system understood and used in industry and government alike.[39]

An *occupation* is comprised of a number of *jobs*, each of which is composed of a unique set of *tasks* or *skills*. Many people assume, mistakenly, that the purpose of any occupational classification system is to establish within-occupation homogeneity with regard to skills required in the performance of the included jobs. This is a false impression, as Scoville's[40] quote from Alba Edwards indicates with

reference to the U.S. Census of Population occupational categories:

> In the analysis of many of the problems which concern workers as people . . . there is, and long has been, a real need for statistics showing in summary form an occupational distribution of the nation's labor force--a need for statistics that cut across industry lines and bring together into one occupationally homogeneous group *all of the workers belonging to the same social economic class, but with minor regard to the occupations [jobs] they pursue* or to the particular part of the industrial field in which they work.

In fact, each classification system has been designed for a specific purpose, or set of purposes, and subsequent adoption for other uses will almost certainly involve interpretation problems which were not anticipated earlier. As we stated in the introductory section, within-group occupational homogeneity is only meaningful in terms of some criterion or purpose.[41] No occupational classification source has been designed to fulfill the need for planning skill-training curricula,[42] although conversions of existing classification systems to interface with vocational-technical education program codes have been published.[43]

In case the importance of occupational classification is still unclear, consider the following questions. Graduates of which skill-training programs have the highest "training-related" placement rates? What occupations exhibit poor retention rates of new hires, and what are the reasons for exit? What can we learn from occupational mobility[44] patterns which might be of interest for educational planning purposes? Can you answer any of these questions without careful consideration of what *occupation* means?

Supply Measurement[45]

Many of the concepts already examined are relevant here too. Individuals must be classified on the basis of whatever criteria are deemed pertinent to the use(s) which will be made of the data. For some purposes, measurement of the number of persons who have achieved a designated threshold of performance may suffice. But, as we have noted, performance may itself be a team concept in a specific employment setting. And, are we to interpret performance standards narrowly in terms of production engineering, or are employer hiring criteria to be considered; and if so, which criteria--today's or projected future

hiring standards? For other purposes, the supply measure should signify availability as well as qualification. Since availability is conditional upon the meeting of certain conditions, we must then either assume a single set of conditions to which availability estimates will be tied, or set forth alternative circumstances with accompanying supply measures.

Assuming these definitional problems have been surmounted, two issues remain unresolved. First, since skill augmentation occurs in both the public and private sectors and in on-the-job and institutional settings, the extent of measurement coverage must be considered explicitly. What are the pros and cons of including or excluding each possible source of supply? And second, where will the line be drawn between formal training as the sole process and learning as the only output, and informal learning which occurs as part of a joint production-training process? For many educational planning purposes, answering this question is a crucial prerequisite to comparing 'requirements' and 'availables'. Of course, the farther one moves along the continuum toward informal joint learning and production, the greater is the difficulty of measurement of skill development.

Summary

This section represents an attempt to imbed the administrative use of occupational employment projections in a more informed context of labor market processes. We have shown that the concept of *shortage* is far from precise and means different things to different people. While immediate job-placements depend on the existence of *job-vacancies*, educational planning must consider projected *job-openings*; a wholly different concept largely unrelated to current willingness and ability to hire. And, adopting Hansen's classification, we have distinguished among projected *requirements*, *availables*, *outcomes*, *outcomes with responses*, and *actuals*. Each concept has different implications for educational planning. Then, a number of sources of adjustment to perceived market imbalance were described, since the multiplicity of responses is a major source of complexity for administrative action in any one sector. Next, the notion of an *internal labor market* was introduced to account for the many institutional restraints educators encounter in attempting to meet apparent skill 'shortages'. This led

logically to a treatment of the *educational requirements* issue, since we have a very limited understanding of what 'requirements' are really rigid and stable over time, and which are malleable or subject to seasonal or cyclical fluctuation. All of this presumes some definition of *occupational classification*, so this issue was raised explicitly. Finally, supply measurement was introduced, since most of the previous concepts apply in this area too.

What remains now is to integrate the disparate concepts introduced up to this point into a useful guide for administrative decision-making in the vocational-technical education sector. Is the use of occupational employment projections for planning purposes truly a mission impossible?

V

EDUCATIONAL PLANNING USES OF LABOR MARKET CONCEPTS

Introduction

The U.S. Department of Labor continues to devote considerable effort to meeting its perception of the needs of vocational-technical education administrators for occupational employment projection information.[46] The limits of DOL-BLS success are characterized by Wirtz and Goldstein as follows:

> Taking particular note of the non-use by federal and state vocational education officials of the Department of Labor information, the GAO report [What Is The Role of Federal Assistance for Vocational Education?, A Report to the Congress by the Comptroller General of the United States, December 1974] attributes this to lack of communication, lack of interest in planning on the basis of manpower needs, and inadequate attention to vocational guidance, work experience, and job placement on the part of vocational educators.[47]

In this final section we explain why communication problems might be expected to persist, and why a lack of interest in planning on the basis of manpower needs is exhibited. We then conclude by responding to the question posed in the title of this essay.

Communication Failures

We begin with the following observation on organizational decision-making:

> For even moderately complex problems . . . the entire decision trees cannot be generated. There are several reasons why this is so: one is the size of the tree. The number of alternative paths in complex decision problems is very large . . . . A second reason is that in most decision situations, unlike chess, neither the alternative paths nor a rule for generating them is available . . . A third reason is the problem of estimating consequences . . . For many problems, consequences of alternatives are difficult, if not impossible to estimate. The comprehensive decision model is not feasible for most interesting decision problems.[48]

Many analysts of educational planning processes seemingly ignore these attributes of the administrative environment.[49] Indeed, one author asserts that "[t]he writer purposely has not dwelt at length on the many aspects of resistance to change, chiefly because of an inherent belief that, if properly motivated and assisted, people have a strong propensity to change, to become committed to providing opportunities for a better education for all persons."[50] But, how can "proper motivation and assistance" happen without inquiry into reasons for resistance to change? Such rhetoric contributes nothing to our search for answers.

The thesis to be developed in the following pages is premised on contradictions which arise from the coexistence of *laissez faire* and interventionist attitudes and actions. Coupled with these contradictions are nonsymmetrical administrative incentives and disincentives associated with being 'right' or 'wrong' in tying educational structure to projected employment opportunity. One source of this asymmetry is varying behavior of constituent groups in the respective circumstances. Under such conditions, it is quite rational for an informed administrator who is quite aware of forecast skill requirements to act in ways which belie such knowledge. The apparent communication weaknesses may, then, be a functional manifestation of the institutional context within which educational activities transpire.

Extraordinary efforts are currently underway to reduce the perceived communications gap between producers and consumers of occupational employment information.[51] A major problem with virtually every attempt which has been made to determine information 'needs' is that no attempt is made to ascertain *effective demand*, i.e. need signalled by a willingness and ability to pay for the information. One reason for continuing inaction is that 'wish lists' cannot be translated into action without

the wherewithal to pay for the information services to be rendered. We must recognize that, despite cooperative agreements between the U.S. Department of Labor and HEW, and not withstanding on-going liaison activities among federal agencies, the *primary* concern of the Division of Manpower and Occupational Outlook in the Bureau of Labor Statistics is presumably to meet Department of Labor Information needs. But there are more fundamental reasons for the appearance of a communications problem, reasons which are grounded in what Williamson et al. refer to as the difference between *perfunctory* and *consummate* cooperation.[52] And this behavioral difference is inextricably intertwined with the politics of educational planning, to which we now turn.

The Politics of Educational Planning

It would be enlightening to examine here the origins and current structure of the vocational-technical education system in the United States, but this is beyond our present purview. The rationale for undertaking such an inquiry would be to document the evolution of a modified *laissez faire* education establishment. In the absence of this historical information, we must simply assert that the domain of control of any administrative level in vocational-technical education reflects the interacting forces of decentralized decision-making and a federal presence.[53] Breneman concludes that, "[s]ince we rely on decentralized decision-making and allocation procedures, it is surely sensible to know as much as possible about the working of those procedures, including their limitations."[54] One difficulty in the federal, and state, presence is that planning sometimes constitutes a threat to the existing educational establishment. But,

> [t]he threat which planning makes to one's freedom of action can be minimised by controlling or participating in the formulation of the plan . . . . . The real problem of educational planning so far has been that it has been carried out mainly by . . . supporting staff . . . rather than being a central concern of the principals.[55]

The significance of this is that educational planners might well heed George Bernard Shaw's paraphrase of the Golden Rule, "Do not do unto others as you would wish them to do unto you. They may have different tastes."[56] It is in this context that the distinction between perfunctory and consummate cooperation is relevant.

Perfunctory performance involves cooperation in accordance with minimally acceptable standards. "[L]egal authority does not and cannot command the employee's willingness to devote his ingenuity and energy to performing his tasks to the best of his ability."[57] *Consummate performance* involves contributing in a fully functional, instrumental manner. The lack of interest in educational planning that the General Accounting Office report alludes to is a manifestation of perfunctory cooperation. Consummate performance, as the GAO sees it, is couched in terms of " . . . as you would wish them to do unto you." The failure to achieve this level of performance is attributed, in part, to communication gaps. Perhaps so, but the search for causes thus far appears to be largely misguided.[58]

Consider the following scenario. Administrators of local education agencies have multiple constituencies--students (past, present and future), parents of students (also past, present and future), taxpayers, school teachers and staff, and local area employers, among others. These are the immediate 'principals', the actors in the local education-employment process. (This effectively ignores the mobility phenomenon which sees many students exit from this local scene to establish careers, only to be replaced many times by outsiders who are educated elsewhere and then enter the local scene to accept employment.) These are the principals because they have the most direct stakes in the local educator's administrative actions. The local employer who has been successful in the past in transferring some training expenses from his establishment to the taxpayers-at-large will, of course, oppose administrative proposals which threaten such an arrangement. Parents of past graduates, and the former students themselves, will respond to administrative action to a degree which depends, in part, on their own employment experiences. Taxpayers and parents of future students seek reassurance that the schools are contributing to the individual and collective economic well-being of the citizens in the community. The teachers and staff members seek job-security and their own economic well-being. The present complement of teachers is characterized by certain capabilities, as is the existing physical plant. This introduces a major impediment to any attempt to meet what we have called idiosyncratic training requirements. And the administrator? He or she must be

responsive in varying degrees to each of these groups which seeks to promote its own self-interest. There must be a *quid pro quo*. I (the administrator) will offer a training program to prepare carpenters if you (the local employing community) will hire the graduates. A part of the contractors' training expenses is absorbed by taxpayers in return for which some local youths are able to establish carpentry careers.

Now, introduce the external state planner, who says "we also need a *quid pro quo*. We (the State Department of Education) must convince the Legislature that their investment of taxpayers' dollars in vocational-technical education is well-conceived." State financial support of vocational-technical education activities represents varying proportions of total local education agency budgets, which translates into varying amounts of political and administrative clout in accomplishing statewide educational goals. The territorial imperative in education is strong, and belief in the inherent goodness of the citizenry is unlikely to be effective in the absence of the mutual benefit from cooperation element.

What role do labor market considerations play in state-level educational administration? We know that the state economy is less "open" than that of each local school district, so entry and exit mobility is conceived differently at the state level than at the local level; not because the respective administrators necessarily differ in their awareness of such movements, or even because they seek different educational objectives, but because they must respond to different manifestations of the same basic phenomenon and because they are beholden to different constituencies. What labor-market evidence would you convey to legislators in an attempt to increase the state allocation to vocational-technical education? A typical strategy is to cite projected 'requirements', i.e. the projected skill 'needs' of the state economy some years hence. Why isn't 'outcomes' or 'outcomes with responses' information presented, with accompanying data on the state education system's proposed role in alleviating projected imbalances? Because the necessary 'availables' and response calculations are not known. Why, then, isn't a major effort launched to obtain such information, *a la* the Wirtz-Goldstein recommendations? Because there is no *quid pro quo*. The 'requirements' measure is ideal from the state education agency's

standpoint, because it ignores both projected availability of qualified persons to meet these requirements and responses which might occur to diminish, or even eliminate any projected shortfall. Who, then, does have a self-interest in presenting the legislature with 'outcomes with responses' projections? Proprietary training institutions should, to the extent that they are competing with public sector schools to meet employer demands for preemployment skill embodiment. If they can convince the legislature that they (the proprietary schools) can meet the projected 'need', they should expect to be rewarded by legislative disinterest in supporting their competitors (the public schools). The *quid pro quo* here is obvious; the legislature can now allocate more money elsewhere. This adversary relationship reveals another source of friction between state and local educational planning. The local area territorial imperative is manifested in a local education agency's desire to hoard information about forecast skill requirements. Widespread dissemination of such information by the state agency would be expected to lead to a more rapid correction of market imbalances, thereby lessening the stability of curricular planning.

Finally, when the federal dollar and accompanying regulations and reporting requirements are introduced, we merely increase the complexity of the forces already discussed. The lesser degree of "openness" at the federal level than at the state or local level, and associated mobility considerations; the importance of the committee structure of Congress and the continual inertia for change; and, the adversary relationship between the public and private sectors, are all reflected in the behavior of the supporting staff on behalf of the principals.

We conclude from this that there is a need to eschew reliance on beliefs in inherent good intentions, to end repetitive appeals for improved communication, and to halt the stream of recommendations to collect more or better information on this and that aspect of our lives. The actors behave as they do because it is in their self-interest to do so, given the institutional context in which they operate. Given the rules of the game, everyone plays to win. There are information imperfections which result in educational outcomes which most of us would agree are undesirable. But, some participants prefer the present situation because they are benefiting from it relative to perceived

alternative circumstances. And these actors will attempt to maintain the status quo. If "most of us" have control of the situation, several options are open. We can *mandate* a change, which requires confidence that "we" can dominate "them" and regulate subsequent action to assure compliance. Or, we can *buy* a change by offering to compensate those who stand to be less well off after the change. The former mandating action changes the rules of the game, and counts on or coerces a desirable response to the new rules. The latter compensating action is merely a more direct route to the same end; one that becomes more attractive as one's superiority of control diminishes.

Returning to the asymmetry between potential rewards to action and anticipated losses from a failure to act, we can now see that virtually no one in an administrative role in the vocational-technical education sector has a strong incentive to contribute consummate performance in using Department of Labor, or anyone elses, employment projections. There is no *quid pro quo*. Professional educators and associated staffs and physical plants are already arrayed across the country. Any inconsistency between employment projections and the range of preferred capabilities of these resources will evoke adoption of a defensive self-serving posture, *just as it would in any other part of the public or private sectors.* Evidence of this asymmetry phenomenon is seen in the administrative enthusiasm expressed about projected newly emerging or rapidly expanding employment opportunities, versus the hostility generated toward evidence of projected decline of opportunity or current abundance of qualified persons.

Isn't this conclusion inconsistent with Parnes' observation quoted earlier, that once having decided that specific skill development in preparation for employment is an educational goal, there is no longer an option to project employment or not? No, because while specific skill development is *an* educational goal, we are not well informed about the connection between this educational activity and subsequent employment activity; and besides, self-preservation within the educational system is also a motivating force.

VI

MISSION IMPOSSIBLE?

Introduction

It should be apparent by now what answer will be forthcoming to this question about the possibility of the assigned mission. We know from observation that the transmitter is operating because we have reams of computer printouts with employment projection information of many types. We also know the receiver is functioning because we see the numbers from the computer printouts showing up in the planning documents of the education agencies. This surface manifestation of a successful transmittal from information producer to information consumer is confounded by evidence that generally only intermediate consumption occurs. Just as ruminating animals bring up a cud from the first stomach to be chewed again, what is really sought in vocational-technical education planning is a cud; a "second chewing" of information which is currently stored in planning documents, to nourish the administration of educational processes.

The Quest For A Vocational-Technical Educators' Cud

Why should an administrator of vocational-technical education resources use employment projection information? If you can answer that, ask yourself why more administrators of vocational-technical education resources don't do so. I think the answer lies in the politics of educational planning and administration--in the absence of the necessary *quid pro quo*.

Why aren't educators more precise in stating what they need in the way of employment projections that they aren't now getting? Because precision of definition is threatening, and therefore of relatively low priority. Perfunctory cooperation is acceptable. This does not necessarily mean that the status quo is known to be indefensible and that it must therefore be protected from exposure to objective scrutiny. It may be that simple risk-aversion motivates the action to avoid specifying information requirements which thereby perpetuates the difficulty of those who would argue that "you know what needs to be done, now do it."

Why haven't accuracy tolerances been established for most of the employment projection systems which are presently operating for vocational-technical education planning purposes? Because specification of such tolerances is unnecessarily threatening. Perfunctory performance is again acceptable under the current rules of the game. And again, one need not infer conspiratorial motives in such action. The failure to define accuracy limits maintains administrative discretion in deciding whether to accept or reject the estimates. Nothing would be gained by adopting rigid guidelines, and a source of autonomy would be lost.

Is an understanding of the concepts defined in this essay going to evoke consummate administrative performance? No. But such an understanding will contribute to a more informed dialogue among the principal actors, between these principals and the support staffs which have already imposed the rule that skill 'requirements' must be considered in planning vocational-technical educational programs, and ultimately between the support staffs and the producers of employment projections.

How can such a dialogue possibly transpire without a common understanding of the difference between *demand* and *employment*, and between a *projection* and a *forecast*? Musn't there be a common understanding of what is meant by *shortage* and by *requirement*? Can those who don't distinguish between a *job-vacancy* and a *projected job-opening* communicate effectively? Could you map-out an educational program without considering the relevance of *internal labor market* phenomena? And do you now see that different occupational classification systems will have very different impacts on educational decisions?

The vigil for dramatic changes in administrative behavior is indeed a mission impossible unless new rules of the game are promulgated. Based on a common understanding of educational and labor market institutional procedures, and making adequate provision to either compensate those who stand to lose under proposed changes, or to garner sufficient support to overcome anticipated adversary action, consummate performance is achievable only by evoking new responses through a different set of incentives and disincentives than now exists. You can lead a horse to water, *and get it to drink*, if you whet its appetite.

44

FOOTNOTES

[1]David E. Kidder, Review and Synthesis of Research on Manpower Forecasting for Vocational-Technical Education, Information Series No. 54 (VT 014 482), ERIC Clearinghouse on Vocational and Technical Education, The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210, February 1972, 70 pp.

[2]See David W. Stevens (ed.), Occupational Employment Projections for Program Planning Purposes: Issues and Examples, The Human Resources Research Program, 217 Middlebush, University of Missouri, Columbia, MO. 65201, January 1976, for the proceedings of a conference of the same title held at the TWA Breech Training Academy, Overland Park, Kansas, July 10-11, 1975; and the "1975 National Vocational Education Research Conference on Management Information Systems at the State Level," sponsored by the Research Branch, Division of Research and Demonstration, Bureau of Occupational and Adult Education, U.S. Office of Education, and held at Des Plaines, Illinois, November 5-7, 1975. No proceedings volume of the latter conference is planned.

[3]In this usage "conditions" is meant to encompass all attributes of compensation and working conditions. It is merely a shorthand way to denote the rewards associated with a given job.

[4]See: U.S. Department of Labor, "Formal Occupational Training of Adult Workers," Manpower/Automation Research Monograph No. 2, December 1964, pp. 43-45; and Willard Wirtz and Harold Goldstein, A Critical Look at the Measuring of Work, Washington, D.C.: The National Manpower Institute, Suite 414, 1211 Connecticut Avenue, N.W., 20036, August 1975, pp. 27-31.

[5]Herbert S. Parnes, "Manpower Analysis in Educational Planning," in Mark Blaug (ed.), The Economics of Education: I, London: Penguin, 1968, pp. 263-273.

[6]Among recommended references are: August C. Bolino, "Occupational Education as a Source of Economic Growth," National Technical Information Service, Springfield, Virginia, 22151 (order number PB-214 189), November 1972, 268 pp; Marvin Lazerson and W. Norton Grubb (eds.), American Education and Vocationalism: A Documentary History 1870-1970, Classics in Education No. 48, New York: Teachers College Press, Columbia University, 1974; Bernard Bailyn, Education in the Forming of American Society: Needs and Opportunities for Study, New York: W. W. Norton and Company, Inc., 1972; Joel H. Spring, Education and the Rise of the Corporate State, Boston: Beacon Press, 1972; and, Robert C. Young, William V. Clive, and Benton E. Miles, Vocational Education Planning: Manpower, Priorities, and Dollars, Research and Development Series No. 68, The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210, 1972, pp. 8-17.

[7]The treatment here follows that of Derek L. Bosworth, Graham J. Evans, and Robert M. Lindley, "Mechanistic Manpower Models," in J. Stuart Wabe (ed.), Problems in Manpower Forecasting, Lexington, MA: Lexington Books, D.C. Heath and Company, 1974, pp. 61-84.

[8]It is also necessary to produce an independent estimate of total employment at the end of the projection period, to be used as a control total since the independent occupation and industry effects have been combined in a way which violates the premises upon which they were generated.

[9]For a technical treatment of this technique see M. Bacharach, Biproportional Matrices and Input-Output Change, Cambridge: Cambridge University Press, 1970.

[10]Guy H. Orcutt, "Simulation of Economic Systems," American Economic Review, L:5 (December 1960), p. 897, quoted in David S. Huang, Regression and Econometric Methods, New York: John Wiley and Sons, Inc., 1970, pp. 3-4.

[11]See: Roger H. Bezdek, Long-Range Forecasting of Manpower Requirements--Theory and Applications, IEEE Monograph, Institute of Electrical and Electronics Engineers, Inc., New York, N.Y., 10017, 1974, pp. 2-12 through 2-16; and, R. G. Hollister, "An Evaluation of a Manpower-Forecasting Exercise," in Mark Blaug (ed.), The Economics of Education, London: Penguin, 1968, pp. 340-342.

[12]Recent contributions which provide many further references include: Richard B. Freeman and David W. Breneman, Forecasting the Ph.D. Labor Market: Pitfalls for Policy, Technical Report Number Two, National Board on Graduate Education, 2101 Constitution Avenue, N.W., Washington, D.C. 20418, April 1974; and from the same source, Doctorate Manpower Forecasts and Policy: A Report With Recommendations of the National Board on Graduate Education, Number Two, November 1973; Margaret S. Gordon (ed.), Higher Education and the Labor Market, New York: McGraw Hill Book Company, 1974; and, Walter Y. Oi, "Scientific Manpower Forecasts from the Viewpoint of a Dismal Scientist," Working Paper No. 47, Industrial Relations Section, Princeton University, May 1974, 90 pp.

[13]A recent source with references to related literature is: U. E. Reinhardt, "Health Manpower Forecasting: Current Methodology and Its Impact On Health Manpower Policy," in Mimeograph, 1974. Also see: Lanis Hicks, Health Manpower Planning: An Annotated Bibliography, Office of Health Manpower Planning, Department of Social Services, 600 E. Capitol Avenue, Jefferson City, MO 65101, June 1975, and Volume II dated September 1975.

[14]See: David W. Breneman, "Examining Past Assessments: Yesterday's Manpower Projections in Retrospect," unpublished paper prepared for the Symposium on the Human Resources of Science and Engineering--Today and Tomorrow, held January 27, 1975; Roger H. Bezdek, loc cit; Bashir Ahamad and Mark Blaug (eds.), The Practice of Manpower Forecasting: A Collection of Case Studies, San Francisco: Jossey-Bass, Inc., 1973; and, J. Stuart Wabe (ed.), Problems in Manpower Forecasting, Lexington, MA.: D. C. Heath and Company, 1974.

[15]Of special interest are: Hollis B. Chenery (ed.), Studies in Development Planning, Harvard Economic Studies Volume 136, Cambridge: Harvard University Press, 1971; F. Champion Ward (ed.), Education and Development Reconsidered (The Bellagio Conference Papers), New York: Praeger Publishers, 1974; Muhammad Shamsul Huq, Education, Manpower, and Development in South and Southeast Asia, New York: Praeger Publishers, 1975; and, George Psacharopoulos, Returns to Education: An International Comparison, San Francisco: Jossey-Bass, Inc., 1973.

[16]A very readable reference in an obscure source is: George Psacharopoulos, "Substitution Assumptions Versus Empirical Evidence in Manpower Planning," De Economist, 121:6 (1973), pp. 609-625.

[17]A very important new book is, Lester Thurow, Generating Inequality, New York: Basic Books Inc., 1975.

[18]R. G. Hollister, op. cit., p. 339.

[19]H. S. Parnes, op. cit., p. 265.

[20]The internal rate of return is the interest rate which equates the discounted stream of benefits accruing to participants in a program to the discounted stream of direct and indirect costs associated with that program.

[21]See, for example, George Psacharopoulos, "Substitution Assumptions ...," op. cit., pp. 622-623; Stuart Wabe, op. cit., pp. 77 ff.; Bernard Rostker, "Manpower Theory and Policy and the Residual Occupational Elasticity of Substitution," Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia, 22151 (Order No. PB 192 061), 1970, 207 pp; T. M. Power, "Elasticities of Substitution Between Different Types of Labor: Theoretical Analysis and Empirical Examples," University Microfilms, Ann Arbor, Michigan (Order No. 72-24, 696), 1972, 252 pp.; Randall D. Weiss, "Elasticities of Demand for Capital and Occupation-Sex Categories of Labor in U.S. Manufacturing Industries 1950 and 1960," Working Paper, Project on the Economics of Discrimination, University of Maryland, College Park, Maryland, undated (1974?), 38 pp; and, William R. Buechner, "Technological Change and the Occupational Composition of the American Labor Force, 1950-1960, "National Technical Information Service, Springfield, Virginia 22151 (Order No. PB-210 631), 1972, 337 pp.; and Richard Tiller, Labor Substitution and Manpower Planning, unpublished Ph.D. dissertation, Columbia, MO: The University of Missouri-Columbia, 1975.

[22]But, see Lester C. Thurow, op. cit., pp. 75-86 for a different treatment.

[23]W. Lee Hansen, "Labor Force and Occupational Projections," 1965 Proceedings of the Industrial Relations Research Association, Madison, Wisconsin, pp. 10-20.

[24]An excellent reference, with citations to earlier contributions, is: Eugene J. Devine, "A Critical Review of Shortage Concepts," in Analysis of Manpower Shortages in Local Government, by the same author, New York: Praeger Publishers, 1970, pp. 3-13.

[25]In fact, this result is not unambiguous because of complex simultaneities between the supply of and demand for physician services.

[26]W. Lee Hansen, loc. cit.

[27]See, for example, Richard B. Freeman, "Occupational Training in Proprietary Schools and Technical Institutes," Discussion Paper Number 332, Harvard Institute of Economic Research, Cambridge, MA 02138, November 1973, 18 pp.

[28]See: Peter B. Doeringer and Michael J. Piore, Internal Labor Markets and Manpower Analysis, Lexington, MA: D. C. Heath and Company, 1971; and Oliver E. Williamson, Michael L. Wachter, and Jeffrey E. Harris, "Understanding the Employment Relation: The Analysis of Idiosyncratic Exchange," The Bell Journal of Economics, 6:1 (Spring 1975), pp. 250-275.

[29]See: Martin Carnoy and Michael Carter, "Theories of Labor Markets and Income Distribution," Palo Alto, CA: Center for Economic Studies, 457 Kingsley Avenue, 94301, 1974, pp. 1-44; and, from the same source, Michael Carter, "Contradiction and Correspondence: An Analysis of the Relation of Schooling to Work," Discussion Paper 75-1, August 1975, 38 pp.

[30]See: Peter B. Doeringer and Michael J. Piore, op. cit., pp. 13-40.

[31]Oliver E. Williamson, et al., loc. cit.

[32]Ibid., p. 257.

[33]Lester C. Thurow, op. cit., pp. 75-97.

[34]Among recent sources which deal with employment turnover phenomena are: Jacob J. Kaufman and John M. Sumansky, Manpower Planning, Occupational Education, and Labor Mobility, Technical Paper No. 1, Center for Occupational Education, North Carolina State University at Raleigh, 1974, 72 pp.; Donald O. Parsons, "Models of Labor Market Turnover: A Theoretical and Empirical Survey," Department of Economics, The Ohio State University, Columbis, Ohio, March 1975, 59 pp.; and, B. O. Pettman, "Some Factors Influencing Labour Turnover: A Review of Research Literature," Industrial Relations Journal, 4:3 (Autumn 1973), pp. 43-61.

[35]See: Sidney A. Fine, "The Use of the *Dictionary of Occupational Titles* as a Source of Estimates of Educational and Training Requirements," The Journal of Human Resources, 3:3 (Summer 1968), pp. 365-366.

[36]See, among many possible references: National Bureau of Economic Research, Human Resources: Fiftieth Anniversary Colloquium VI, New York: Columbia University Press, 1972, 97 pp.; Jacob Mincer, Schooling, Experience, and Earnings, Human Behavior and Social Institutions No. 2, New York: Columbia University Press, 1974; and, Edward F. Denison, Accounting for United States Economic Growth 1929-1969, Washington, D.C.: The Brookings Institution, 1974, pp. 219-259.

[37]See, for example: Richard C. Edwards, Michael Reich, and David M. Gordon, Labor Market Segmentation, Lexington, MA: D. C. Heath and Company, 1975, (particularly pp. 3-26 and 151-167); and in a different vein, Kenneth J. Arrow, "Higher Education as a Filter," Journal of Public Economics, 2 (1973), pp. 193-216; and, Joseph E. Stiglitz, "The Theory of 'Screening', Education, and the Distribution of Income," Technical Report No. 148, Institute for Mathematical Studies in the Social Sciences, Stanford University, Stanford, CA, October 1974, 43 pp.

[38]A starting point for understanding educational production processes is: Mehar Arora, "Survey of Literature Regarding Production Functions of Education and Their Applications Specially in Educational Planning," Socio-Economic Planning Sciences, 6:6 (December 1972), pp. 507-522; and, John Heim and Lewis Perl, "The Educational Production Function: Implications for Educational Manpower Policy," Institute of Public Employment Monograph:4, New York State School of Industrial and Labor Relations, Cornell University, Ithaca, NY 14850, June 1974.

[39]Willard Wirtz and Harold Goldstein, op. cit., pp. 32-33.

[40]Alba M. Edwards, Comparative Occupational Statistics for the U.S. 1870-1940, quoted in James G. Scoville, Manpower and Occupational Analysis: Concepts and Measurements, Lexington, MA: D. C. Heath and Company, 1972, p. 25 (emphasis added by Scoville).

[41]See: Glen G. Cain, W. Lee Hansen, and Burton Wiesbrod, "Occupational Classification: An Economic Approach," Monthly Labor Review, 90:2 (February 1967), pp. 48-52; and, Alan Roskam and Michael Podgursky, Occupational Classification Systems and Vocational Education Planning, Jefferson City, MO: Research Coordinating Unit, Missouri Department of Elementary and Secondary Education, Jefferson Building, 65101, 1975.

[42]A recent addition to the literature on occupational analysis is: Krishan K. Paul and Paul V. Braden, Occupational Analysis of Educational Planning, Columbus, OH: Charles E. Merrill Publishing Company, 1975, 144 pp.

[43]See: U.S. Department of Labor, Bureau of Labor Statistics, Matching Occupational Classifications to Vocational Education Program Codes, Tomorrow's Manpower Needs Supplement 3 (Revised), 1975, 56 pp.

[44]See: Robert C. DauffenBach, Jr., The Structure of Occupational Mobility in the U.S. Economy, Ann Arbor, MI: University Microfilms (Order No. 74-11, 999), 1973, 317 pp.

[45]An outstanding single source is: U.S. Department of Labor, Bureau of Labor Statistics, Occupational Supply: Concepts and Sources of Data for Manpower Analysis, Bulletin 1816, 1974, 70 pp.

[46]See: Richard E. Dempsey, "The Bureau of Labor Statistics Employment Projection Program," in David W. Stevens (ed.), op. cit., pp. 60-69; and the following U.S. Department of Labor, Bureau of Labor Statistics publications--"Occupational Manpower and Training Needs," Bulletin 1824 (Revised 1974); "Tomorrow's Manpower Needs: Research Report on Manpower Projection Methods," Bulletin 1769, 1973; and, "Tomorrow's Manpower Needs: Volume 1. Developing Area Manpower Projections," Bulletin No. 1606, February 1969.

[47]Willard Wirtz and Harold Goldstein, op. cit., p. 32.

[48]J. Feldman and H. Kanter, "Organizational Decision-Making," in J. March (ed.), Handbook of Organizations, Chicago: 1965, p. 615, as quoted in Oliver Williamson et al., op. cit., p. 262.

[49]See, for example: Joseph E. Malinski, Planning Techniques for Local Programs of Vocational Education, Information Series 63 (VT 014 964), ERIC Clearinghouse on Vocational and Technical Education, The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210, July 1972; and, from the same source, James E. Wall, Review and Synthesis of Strategies for Effecting Change in Vocational and Technical Education, Information Series 59 (VT 014 704), April 1972.

[50]James E. Wall, op. cit., p. 51.

[51]Wirtz and Goldstein refer to an unspecified forthcoming study of communications limitations conducted under National Institute of Education auspices. Also see: Donald W. Drewes et al., Questions in Vocational Education, Career and Vocational Education Professional Development Report No. 18, Center for Occupational Education, School of Education, North Carolina State University at Raleigh, 1975; and, from the same source, Project EDNEED: Classification of Information for the Development of a National Vocational Education Information System, March, 1975, pp. 73 and 113.

[52]Oliver E. Williamson, et al., op. cit., p. 266.

[53]A highly informative examination of a much more severe departure from private sector industrial autonomy in providing training is: B. O. Pettman, Training and Retraining: A Basis For the Future, London: Transcripta Books, 1973, 135 pp., which is a report of a conference convened to discuss proposed changes in the British training structure. Also see: Keith Hartley, "Industrial Training and Public Policy: From Industrial Training Boards to the State Manpower Bank," in A. J. Culyer (ed.), Economic Policies and Social Goals, New York: St. Martins Press, 1974, pp. 113-137.

[54]David W. Breneman, "Examining Past Assessments...," op. cit., p. 7.

[55]Gareth Williams, "What Educational Planning Is About," Higher Education, 1:4 (November 1972), p. 383 and 384.

[56]Quoted in Joseph Froomkin, "Long-Range Planning in Perspective," in Organization for Economic Co-operation and Development, Long-Range Policy Planning in Education, Paris, 1973, p. 296.

[57]P. Blau and W. Scott, Formal Organizations, San Francisco: 1962, p. 140, quoted in Oliver E. Williamson et al., op. cit., p. 266.

[58]A recent example, in a more general context than just vocational-technical education is: Organisation for Economic Co-operation and Development, Education and Working Life in Modern Society, Paris, 1975, 44 pp.

BIBLIOGRAPHY

(The number in parentheses after some references is the footnote number where complete mailing address and ordering information can be found if it was known to the author.)

Ahamad, Bashir, and Mark Blaug (eds.), The Practice of Manpower Forecasting: A Collection of Case Studies, San Francisco, CA: Jossey-Bass, Inc., 1973.

Arora, Mehar, "Survey of Literature Regarding Production Functions of Education and Their Applications Specially in Educational Planning," Socio-Economic Planning Sciences, 6:6 (December 1972), 507-522.

Arrow, Kenneth J., "Higher Education as a Filter," Journal of Public Economics, 2 (1973), 193-216.

Bacharach, M., Biproportional Matrices and Input-Output Change, Cambridge: Cambridge University Press, 1970.

Bailyn, Bernard, Education in the Forming of American Society: Needs and Opportunities For Study, New York: W. W. Norton and Company, Inc., 1972.

Bezdek, Roger H., Long-Range Forecasting of Manpower Requirements--Theory and Applications, New York: Institute of Electrical and Electronics Engineers, Inc., 1974. (11)

Bolino, August C., "Occupational Education as a Source of Economic Growth," Springfield, VA: The National Technical Information Service, November 1972. (6)

Bosworth, Derek L., Graham J. Evans, and Robert M. Lindley, "Mechanistic Manpower Models," in J. Stuart Wabe (ed.), Problems in Manpower Forecasting, Lexington, MA: D.C. Heath and Company, 1974, 61-84.

Breneman, David W., "Examining Past Assessments: Yesterday's Manpower Projections in Retrospect," Washington, DC: The Brookings Institution, January 1975. (14)

Buechner, William R., "Technological Change and the Occupational Composition of the American Labor Force, 1950-1960," Springfield, VA: National Technical Information Service, 1972. (21)

Cain, Glen G., W. Lee Hansen, and Burton Wiesbrod, "Occupational Classification: An Economic Approach," Monthly Labor Review, 90:2 (February 1967), 48-52.

Carnoy, Martin, and Michael Carter, "Theories of Labor Markets and Income Distribution," Palo Alto, CA: Center for Economic Studies, 1974. (29)

Carter, Michael, "Contradiction and Correspondence: An Analysis of the Relation of Schooling to Work," Palo Alto, CA: Center for Economic Studies, August 1975. (29)

Center for Occupational Education, Project EDNEED: Classification of Information for the Development of a National Vocational Education Information System, Raleigh, NC: North Carolina State University at Raleigh, March 1975. (51)

Chenery, Hollis B. (ed.), Studies in Development Planning, Cambridge, MA: Harvard University Press, 1971. (15)

DauffenBach, Robert C., Jr., The Structure of Occupational Mobility in the U.S. Economy, Ann Arbor, MI: University Microfilms, 1973. (44)

Dempsey, Richard E., "The Bureau of Labor Statistics Employment Projections Program," in D. W. Stevens (ed.), Occupational Employment Projections for Program Planning Purposes, Columbia, MO: The University of Missouri-Columbia, 1976, 60-69.

Denison, Edward F., Accounting for United States Economic Growth, 1929-1969, Washington, DC: The Brookings Institution, 1974.

Devine, Eugene J., Analysis of Manpower Shortages in Local Government, New York: Praeger Publishers, 1970. (24)

Doeringer, Peter B., and Michael J. Piore, Internal Labor Markets and Manpower Analysis, Lexington, MA: D. C. Heath and Company, 1971.

Drewes, Donald W., et al., Questions in Vocational Education, Raleigh, NC: North Carolina State University at Raleigh, 1975. (51)

Edwards, Richard C., Michael Reich, and David M. Gordon, Labor Market Segmentation, Lexington, MA: D. C. Heath and Company, 1975.

Fine, Sidney A., "The Use of the *Dictionary of Occupational Titles* as a Source of Estimates of Educational and Training Requirements," The Journal of Human Resources, 3:3 (Summer 1968), 363-375.

Freeman, Richard B., and David W. Breneman, Forecasting the Ph.D. Labor Market: Pitfalls for Policy, Washington, DC: National Board on Graduate Education, April 1974. (12)

Freeman, Richard B., "Occupational Training in Proprietary Schools and Technical Institutes," Cambridge, MA: Harvard Institute of Economic Research, November 1973. (27)

Froomkin, Joseph, "Long-Range Planning in Perspective," in Organization for Economic Co-operation and Development, Long-Range Policy Planning in Education, Paris, 1973, 277-297.

Gordon, Margaret S. (ed.), Higher Education and the Labor Market, New York: McGraw Hill Book Company, 1974.

Hansen, W. Lee, "Labor Force and Occupational Projections," Proceedings of the Industrial Relations Research Association, Madison, WI: University of Wisconsin-Madison, 1965. (23)

Hartley, Keith, "Industrial Training and Public Policy: From Industrial Training Boards to the State Manpower Bank," in A. J. Culyer (ed.), Economic Policies and Social Goals, New York: St. Martin's Press, 1974, 113-137.

Heim, John, and Lewis Perl, "The Educational Production Function: Implications for Educational Manpower Policy," Institute of Public Employment Monograph: 4, Ithaca, NY: Cornell University, June 1974. (38)

Hicks, Lanis, Health Manpower Planning: An Annotated Bibliography, Jefferson City, MO: Office of Health Manpower Planning, June 1975 (and Volume II dated September 1975). (13)

Hollister, R. G., "An Evaluation of a Manpower Forecasting Exercise," in Mark Blaug (ed.), The Economics of Education: I, London: Penguin, 1968, 338-348.

Huq, Muhammad Shamsul, Education, Manpower, and Development in South and Southeast Asia, New York: Praeger Publishers, 1975. (15)

Kaufman, Jacob J., and John M. Sumansky, Manpower Planning, Occupational Education, and Labor Mobility, Raleigh, NC: North Carolina State University, 1974. (34)

Kidder, David E., Review and Synthesis of Research on Manpower Forecasting for Vocational-Technical Education, Columbus, OH: The Ohio State University, 1972. (1)

Lazerson, Marvin, and W. Norton Grubb (eds.), American Education and Vocationalism: A Documentary History 1870-1970, New York: Columbia University Press, 1974. (6)

Malinski, Joseph E., Planning Techniques for Local Programs of Vocational Education, Columbus, OH: The Ohio State University, July 1972. (49)

Mincer, Jacob, Schooling, Experience, and Earnings, New York: Columbia University Press, 1974. (36)

National Board on Graduate Education, Doctorate Manpower Forecasts and Policy, Washington, DC: November 1973. (12)

National Bureau of Economic Research, Human Resources: Fiftieth Anniversary Colloquium VI, New York: Columbia University Press, 1972. (36)

Oi, Walter Y., "Scientific Manpower Forecasts From the Viewpoint of a Dismal Scientist," Princeton, NJ: Princeton University, May 1974.

Organisation for Economic Co-operation and Development, Education and Working Life in Modern Society, Paris, 1975.

Orcutt, Guy H. "Simulation of Economic Systems," American Economic Review, L:5 (December 1960), 893-906.

Parnes, Herbert S., "Manpower Analysis in Educational Planning," in Mark Blaug (ed.), The Economics of Education: I, London: Penguin, 1968, 263-273.

Parsons, Donald O., "Models of Labor Market Turnover: A Theoretical and Empirical Survey," Columbus, OH: The Ohio State University, March 1975. (34)

Paul, Krishan K., and Paul V. Braden, Occupational Analysis of Educational Planning, Columbus, OH: Charles E. Merrill Publishing Company, 1975.

Pettman, B. O., Training and Retraining: A Basis for the Future, London: Transcripta Books, 1973. (53)

_____, "Some Factors Influencing Labour Turnover: A Review of Research Literature," Industrial Relations Journal, 4:3 (Autumn 1973), 43-61.

Power, T. M., "Elasticities of Substitution Between Different Types of Labor: Theoretical Analysis and Empirical Examples," Ann Arbor, MI: University Microfilms, 1972. (21)

Psacharopoulos, George, Returns to Education: An International Comparison, San Francisco: Jossey-Bass, Inc., 1973.

_____, "Substitution Assumptions Versus Empirical Evidence in Manpower Planning," De Economist, 121:6 (1973), 609-625.

Reinhardt, U. E., "Health Manpower Forecasting: Current Methodology and Its Impact on Health Manpower Policy," in Mimeograph, 1974, 19-58.

Roskam, Alan, and Michael Podgursky, Occupational Classification Systems and Vocational Education Planning, Jefferson City, MO: Missouri Department of Elementary and Secondary Education, 1975. (41)

Rostker, Bernard, "Manpower Theory and Policy and the Residual Occupational Elasticity of Substitution," Springfield, VA: Clearinghouse for Federal Scientific and Technical Information, 1970. (21)

Scoville, James G., Manpower and Occupational Analysis: Concepts and Measurements, Lexington, MA: D. C. Heath and Company, 1972. (40)

Spring, Joel H., Education and the Rise of the Corporate State, Boston: Beacon Press, 1972.

Stevens, David W. (ed.), Occupational Employment Projections for Program Planning Purposes, Columbia, MO: The University of Missouri-Columbia, 1976. (2)

Stiglitz, Joseph E., "The Theory of 'Screening', Education, and the Distribution of Income," Stanford, CA: Stanford University, October 1974. (37)

Thurow, Lester C., Generating Inequality, New York: Basic Books, Inc., 1975.

Tiller, Richard, Labor Substitution and Manpower Planning, unpublished Ph.D. dissertation, Columbia, MO: The University of Missouri-Columbia, 1975. (21)

U.S. Department of Labor, "Formal Occupational Training of Adult Workers," Manpower/Automation Research Monograph No. 2, December 1964, 43-45.

U.S. Department of Labor, Bureau of Labor Statistics, Tomorrow's Manpower Needs: Volume I. Developing Area Manpower Projections, Bulletin No. 1606, February 1969.

_____, Tomorrow's Manpower Needs: Research on Manpower Projection Methods, Bulletin 1769, 1973.

_____, Occupational Manpower and Training Needs, Bulletin 1824 (Revised), 1974.

_____, Occupational Supply: Concepts and Sources of Data for Manpower Analysis, Bulletin 1816, 1974.

_____, Matching Occupational Classifications to Vocational Education Program Codes, Tomorrow's Manpower Needs Supplement 3 (Revised), 1975.

Wabe, J. Stuart (ed.), Problems in Manpower Forecasting, Lexington, MA: D. C. Heath and Company, 1974.

Wall, James E., Review and Synthesis of Strategies for Effecting Change in Vocational and Technical Education, Columbus, OH: The Ohio State University, April 1972. (49)

Ward, F. Champion (ed.), Education and Development Reconsidered, New York: Praeger Publishers, 1974. (15)

Weiss, Randall D., "Elasticities of Demand for Capital and Occupation-Sex Categories of Labor in U.S. Manufacturing Industries 1950 and 1960," College Park, MD: University of Maryland, undated. (21)

Williams, Gareth, "What Educational Planning Is About," Higher Education, 1:4 (November 1972), 381-390.

Williamson, Oliver E., Michael L. Wachter, and Jeffrey E. Harris, "Understanding the Employment Relation: The Analysis of Idiosyncratic Exchange," The Bell Journal of Economics, 6:1 (Spring 1975), 250-275.

Wirtz, Willard, and Harold Goldstein, A Critical Look at the Measuring of Work, Washington, DC: The National Manpower Institute, August 1975. (4)

Young, Robert C., William V. Clive, and Benton E. Miles, Vocational Education Planning: Manpower, Priorities, and Dollars, Columbus, OH: The Ohio State University, 1972. (6)

CE 010 119